



Empowering High-Tech Industries with Ultra-Precision Machining Solutions:

**Introducing our Micro Tools for Unparalleled Precision and Superior
Microfabrication**

Micro Diamond Corporation

Yokohama JAPAN

July 2023

Our Vision

We aim for a global leader in the single crystal diamond micro tool marketplace.



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1. Who we are

We are a leading company specializing in ultra-precision machining solutions for various high-tech industries. We produce and sell high-quality single crystal diamond micro tools for extremely precise and superior microfabrication.



Yokohama city

Micro Diamond Corporation

| | |
|----------------|---|
| Representative | Hirokuni Nakajima (CEO) |
| Capital | 10,000,000 JPY |
| Founded in | January 2000 |
| Head Office | Kannaiekimaedaini Building 2-9 Minato-cho Naka-ku Yokohama-shi Kanagawa, 231-0017, Japan |
| Phone | +81-45-228-8001 |
| URL | http://www.micro-dia.com/ |



2. What we are doing

■ **Pioneers in Ultra-Precision Machining Solutions for High-Tech Industries**

- We are a leading company specializing in ultra-precision machining solutions that are applicable across a wide range of high-technology fields.

■ **Cutting-Edge Microtools for Fine, Precision, and High-Grade Machining**

- Our expertise lies in researching, developing, manufacturing, and selling microtools designed for fine, precise, and high-grade machining. Our tools utilize cutting-edge materials such as single-crystal diamond and pcd (poly crystal diamond) for superior performance.

■ **Trusted by Prominent Companies in Automotive, Semiconductor, Medical, and Precision Instrument Manufacturing**

- Our equipment has earned the trust of numerous large-scale companies, who rely on us for their manufacturing processes in the automotive, semiconductor, medical, and precision instrument industries. We are proud to have delivered our cutting-edge solutions to these esteemed partners.



3-1. Proprietary advanced technology

Single crystal diamond

ACC

Both endmills and turning tools are available. They are designed for ultra precision and super-high quality microfabrication. The minimum radius of single flute ball endmill is R5 μ m.

PRIMO

Only endmills are available. They are designed for machining nonferrous metal or plastics.

Poly crystal diamond

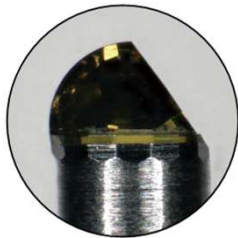
PCD

Various designs are available in order to meet customers' requirements.

3-2. Proprietary advanced technology

Single crystal diamond

ACC



Ball, radius and square endmills with single flute are available. They do not need to screw down the edge made of 2 pieces as the conventional endmills require. Therefore, the effective length can be set in case of diameter or radius size as follows.

Ball : radius $\geq R0.02\text{mm}$ (diameter = 0.04mm)

Radius & Square : diameter $\geq 0.1\text{mm}$

PRIMO



Ball and radius endmills with single flute are available, and each major specification as follows.

Ball : radius \times effective length = $R0.5 \times 3\ell$,
 $R1 \times 6\ell$

Radius : diameter \times effective length =
 $1 \times 3\ell$, $2 \times 6\ell$

Poly crystal diamond

PCD

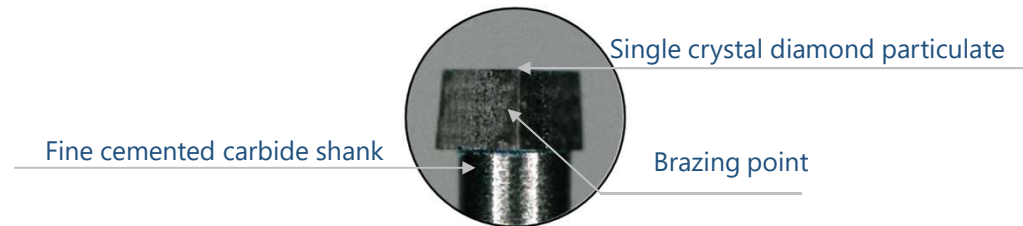


Various designs are available in order to meet customers' requirements.

3-3. Proprietary advanced technology

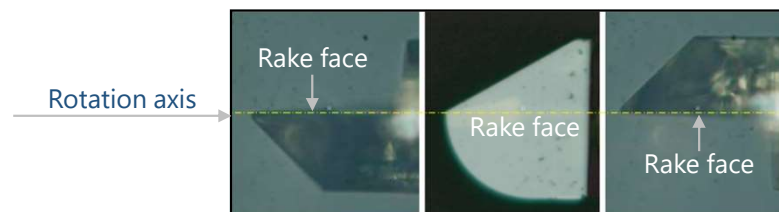
◆ Brazing of micro tools

Technology of brazing single crystal diamond particulates directly on the narrow tip of a fine cemented carbide shank firmly by chemical and physical reaction.



◆ Precision grinding of micro tools

Technology of grinding precisely the rake face or the top of circular arc edge of single flute micro ball endmills within the limit of 3 μm against the rotation axis.



The position of the rake face and the top of arc against the rotation axis. The rake face keeps the same position even if the tool inverted.

4. Our micro tools

Our endmills are the perfect solution for achieving ultra-fine, precise, and high-quality microfabrication with shrinkage fitting. They enable machines and tools to perform at their maximum potential, delivering exceptional results every time.

Single crystal diamond used for cutting edge



We normally use synthetic crystal diamond. We use natural single crystal diamond only with a few limited items, and only when a customer specifically designate to use them.

Single crystal diamond micro endmills



We've standardized the manufacturing process for single crystal diamond endmills and implemented our proprietary grinding system for micro tool production. This has enabled a rapid delivery system. Our innovation has also unlocked new possibilities for diverse micro cutting edge designs that were previously challenging. As a result, our market reach continues to grow.

PCD (poly crystal diamond) micro rotating tools



We supply PCD micro tools as well in order to meet customers' requirements.

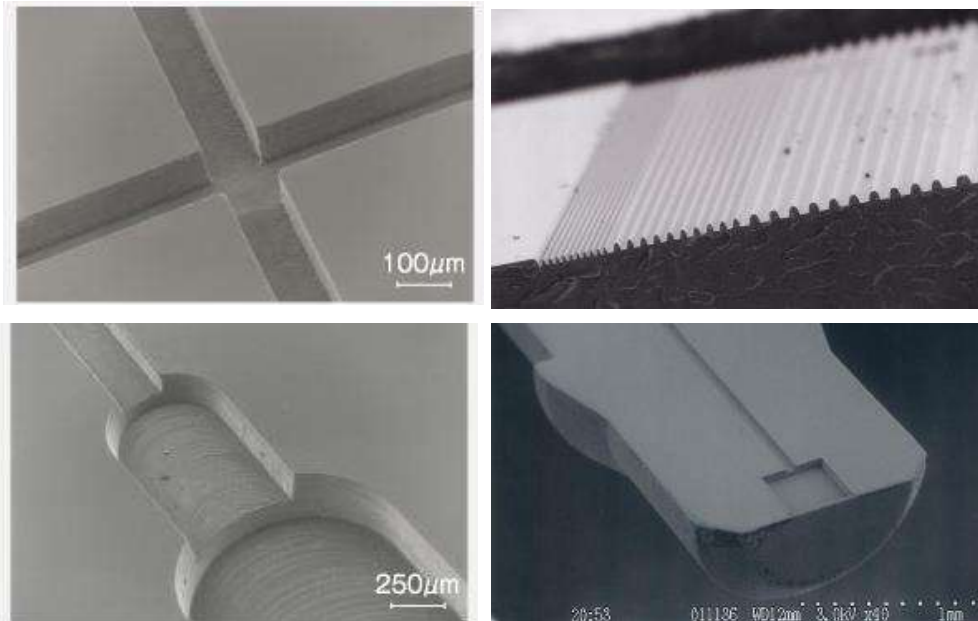
5-1. Micro-Total Analysis System (μ -TAS) Cutting

Advantages of cutting with our ultra-precision single crystal diamond tools

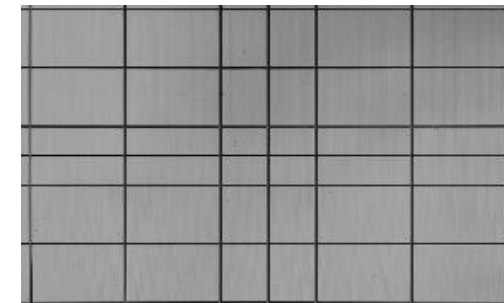
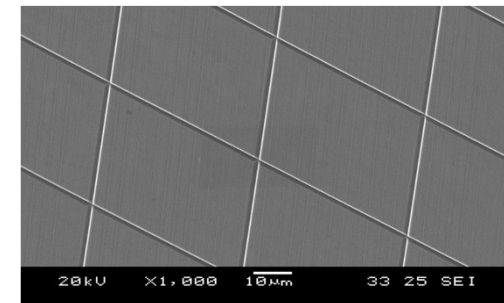
| | Cutting process | Electroforming process |
|---------------------------------------|---|---|
| Number of processes to molding | 2 processes: mold making → molding | More than 4 processes such as inverted mold fabrication process by electroforming |
| Dimensional Tolerance | $\pm 1\mu\text{m}$ | $\pm 5\mu\text{m}$ |
| Delivery timing | Within 1 month | Around 2 months |
| Error Risk | Low risk due to small number of processes | The number of processes is large, so there is a risk of errors in each process. |
| Edge sharpness | Superior sharpness | Corners tend to be dull. |
| Corresponding shapes | Complex shapes can also be accepted. | Limited to simple shapes |

5-2. Micro-Total Analysis System (μ -TAS) Cutting

μ -TAS Processing Sample Images

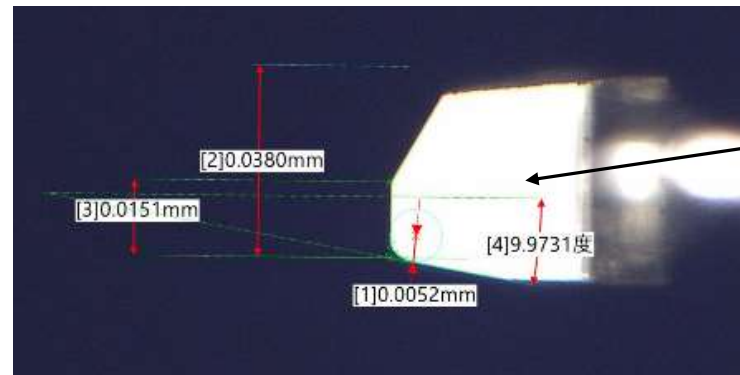
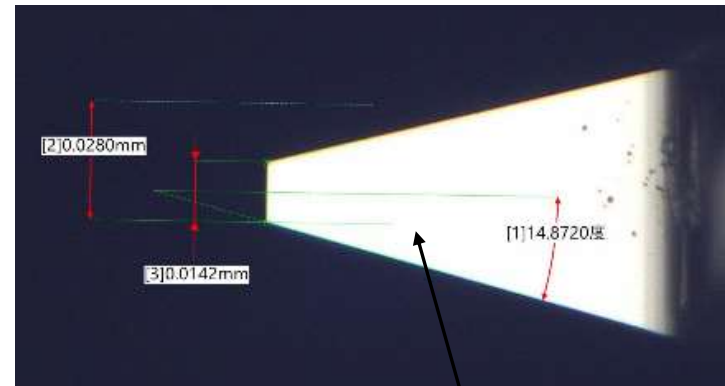
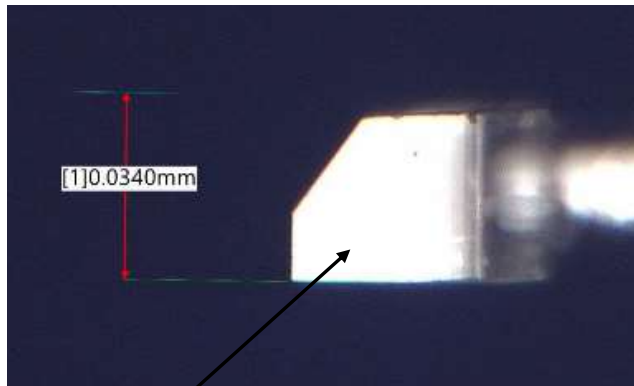


Groove width 0.3 to 1.0 mm, depth 0.5 to 0.8 mm



5-3. Micro-Total Analysis System (μ -TAS) Cutting

Single crystal diamond micro tools



6. Our technology is applied in various high-technology fields



Automobile

LED headlights (PES)
Guide Lights
Head-up display

Various test
workings for end
users



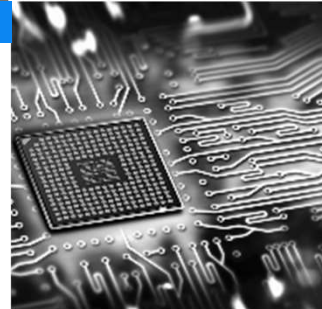
Machine Tools



Optical Lense

Camera lenses
Fresnel lenses
DOE

Drilling a huge
number of holes in
SiC wafer



Semiconductor



Medical Lense

Intraocular lenses
Micro-TAS

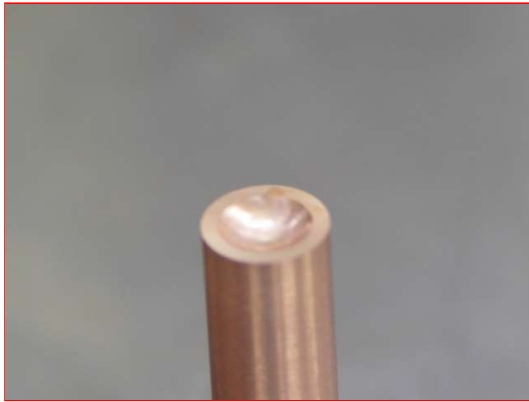
Finishing hands,
dials, bezels and
cases



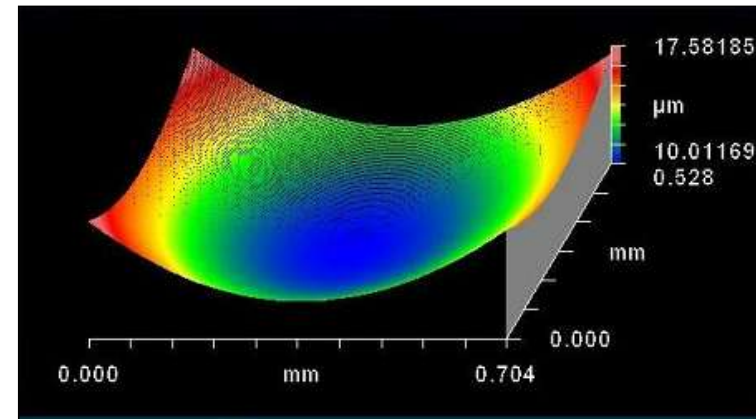
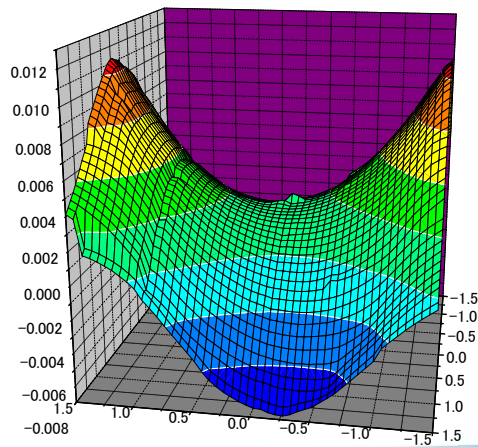
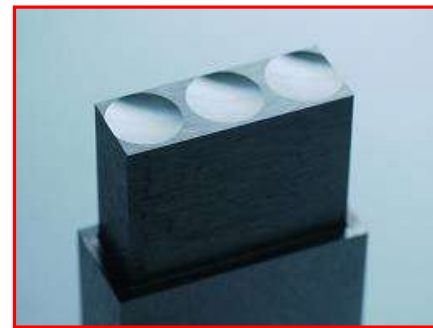
Watch

6-1 Processing examples - Lens

Ni-P Aspherical lens mold
Riken Corp

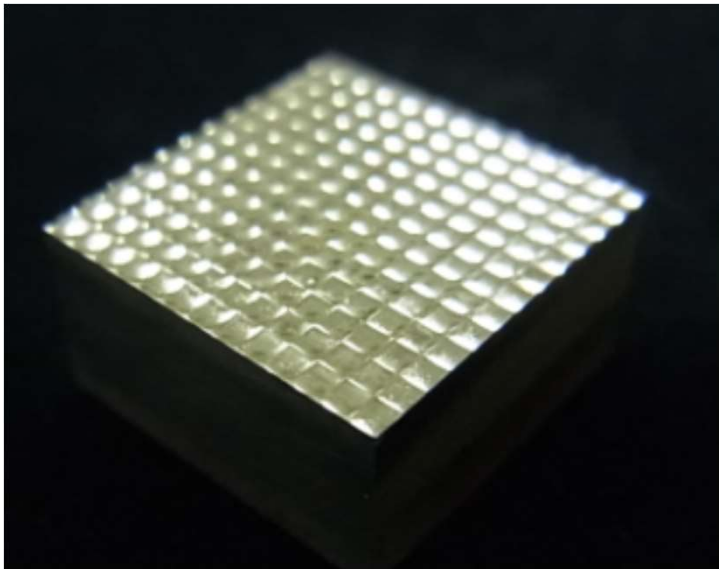


Carbide lens molds
Fanuc Corp

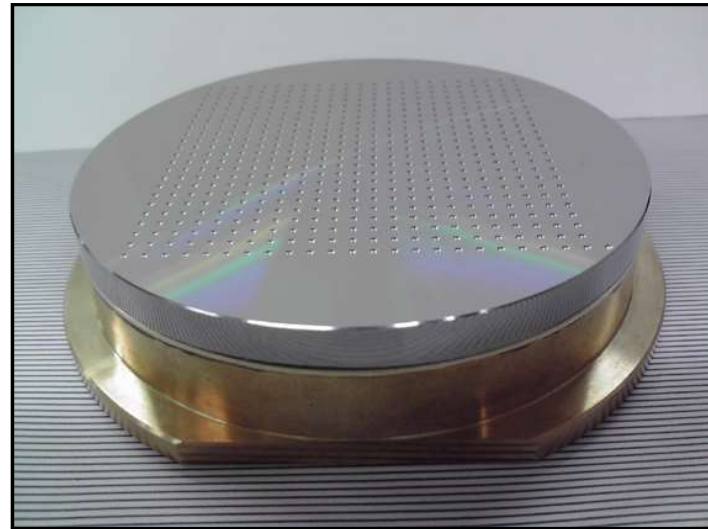


6-2 Processing examples - Lens Array

Ni-P Micro lens array mold
Kyoei Engineering K.K.



Ni-P Micro lens array mold
Chub University



6-3 Processing examples - Fresnel lens

Ni-P Aspherical fresnel lens mold
Kyoei Engineering K.K.



Acrylic fresnel lens mold
Ikegami Mold Engineering



6-4 Processing examples - Large fresnel lens

Acrlic $\phi 1.5\text{m}$ Large fresnel lens
Riken Corp



The article by Nikkan Kogyo Shimbun, Ltd

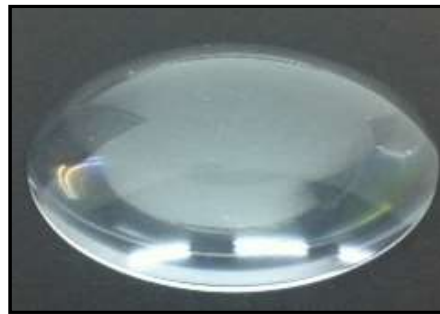


6-5 Processing examples - Resin product processing

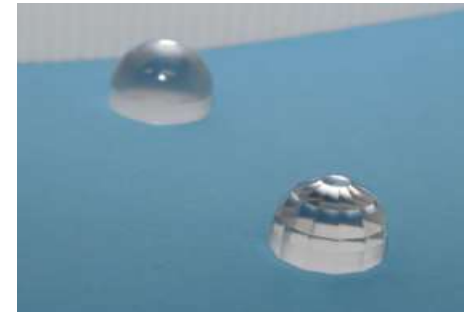
Transparent acrylic cutting process
K.K. S.E.Works



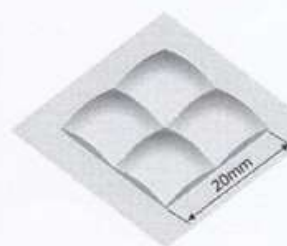
Transparent acrylic cutting process
Kyoei Engineering K.K.



Transparent acrylic cutting process
Kyoei Engineering K.K.

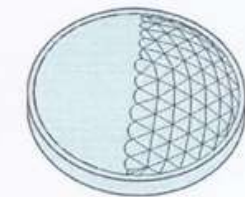


Transparent acrylic cutting process (Lens)
Shibaura Machine



レンズ形状
レンズ中心厚み：3.4mm
レンズ曲面形状：非球面

Transparent acrylic cutting process (Headlight)
Shibaura Machine



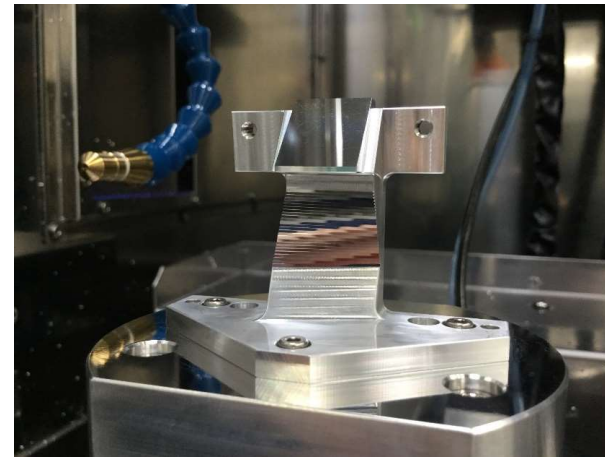
レンズ面形状
Φ60mm球面
+ 半面プリズム面
(丸板素材から削り出し)

6-6 Processing examples - Non-ferrous metal processing

Aluminum micro cutting (Compact case mold)
Roku-Roku Sangyo Ltd.

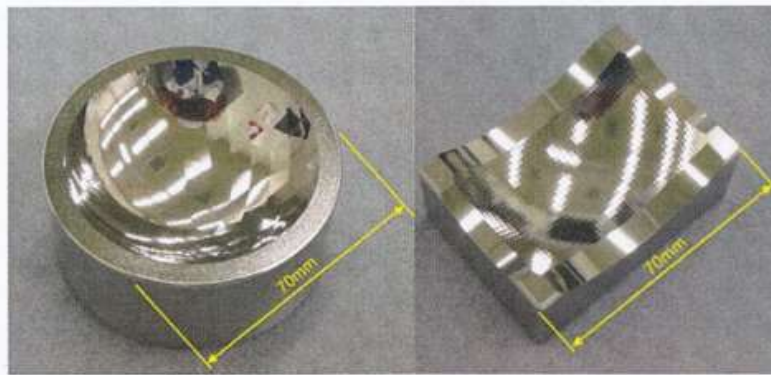


Mirror machined aluminum
Riken

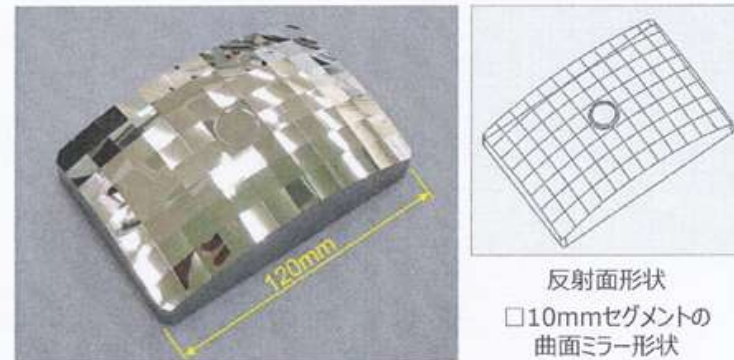


6-7 Processing examples - Automotive exterior molds

NiP Headlight mold
Shibaura Machine

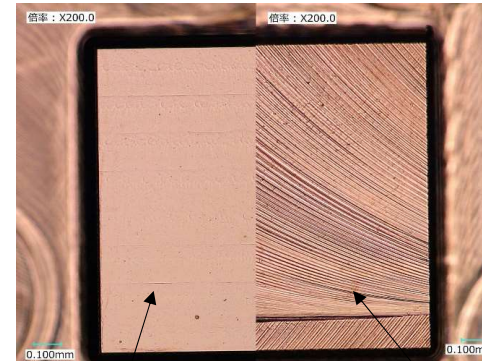
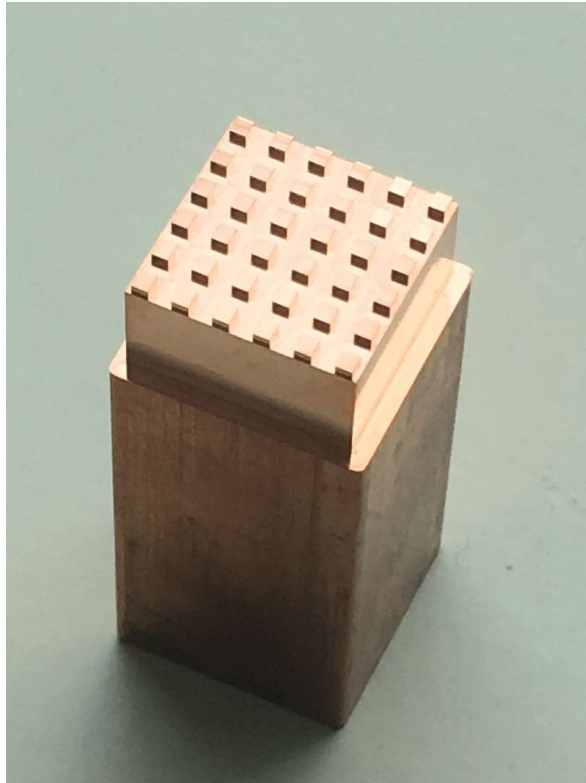


NiP Reflector lamp mold
Shibaura Machine



6-8 Processing examples - Copper electrode processing

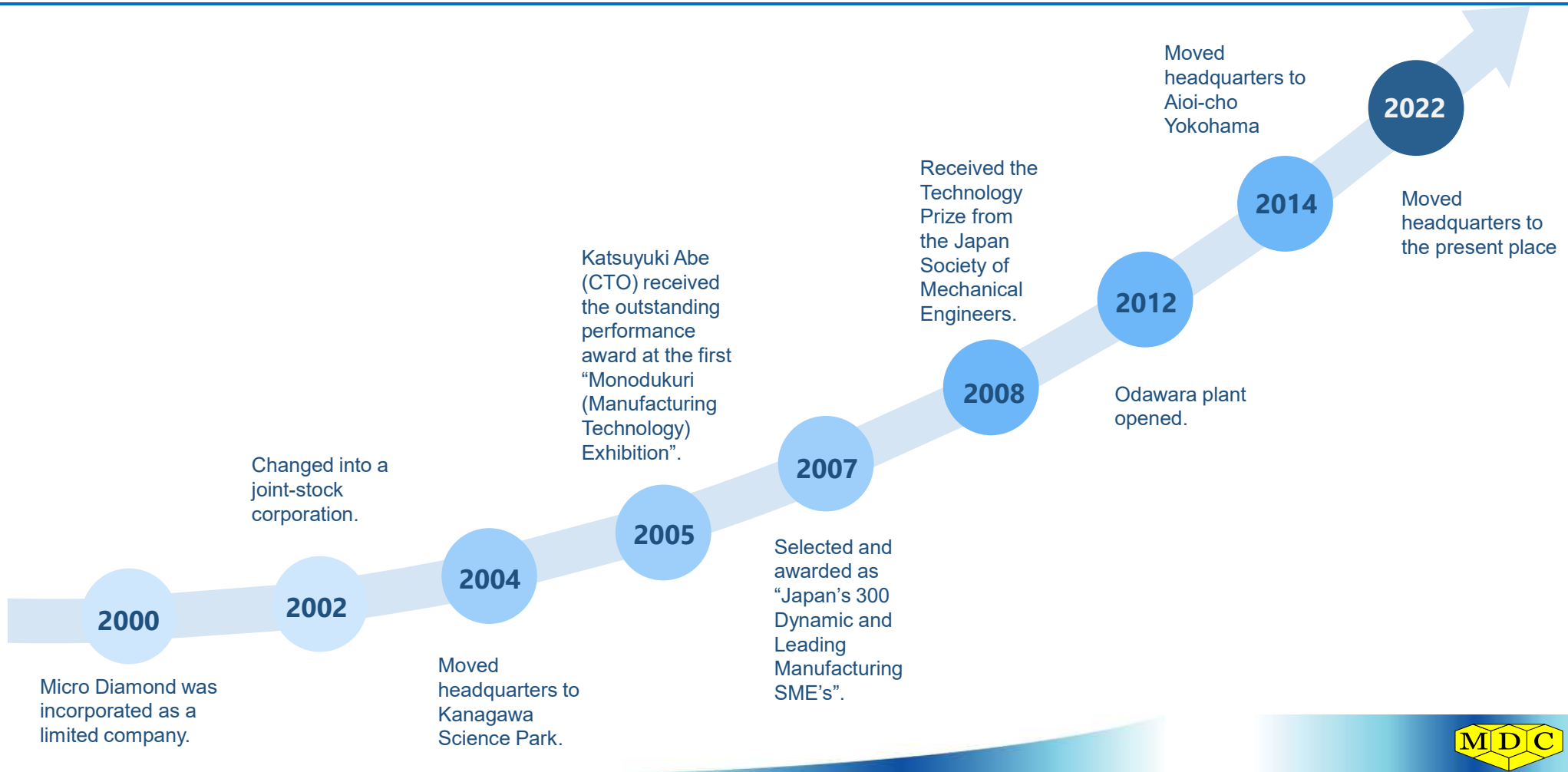
Electrode processing for
electrical discharge cutting



Cutting surface with
monocrystalline
diamond tool

Cutting surface with
carbide tools

7. Our over 20-year history



8. Our Clients

HONDA
The Power of Dreams

KōITO

STANLEY

RICOH



Panasonic

Canon

CASIO

SEIKO

CITIZEN

 **Menicon**

Kowa

FANUC

 **NAGASE**
Delivering next.



 **MAKINO**

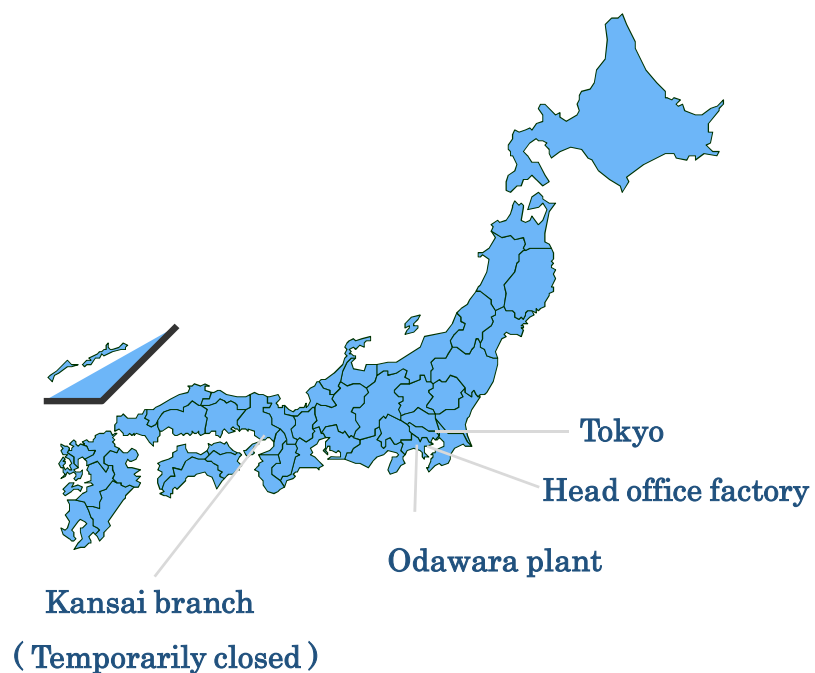


 **JAMSTEC** 国立研究開発法人
海洋研究開発機構
Japan Agency for Marine-Earth Science and Technology

(listed in) no particular order



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